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# Psychological Approaches to Acute Pediatric Pain Management

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Running head: PREPARATION AND MANGEMENT

Psychological Approaches to Acute Pediatric Pain Management

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### Abstract

Children endure numerous acute painful events, most of which occur within the medical arena. For instance, by the time a child reaches the age of 6, the child will have experienced approximately 30 immunization injections (Centers for Disease Control and Prevention, 2008). Grounded in the Gate Control Theory (Melzack & Wall, 1965), psychological methods of pain management have focused on anxiety and pain management via behavioral means. In addition, ample research has been devoted to how best to prepare children and their parents for upcoming painful or distress-provoking procedures (e.g., surgery, hospitalization, injection). This paper will review the preparation literature, which details how to inform and arm children and their parents for impending procedures and will highlight the psychological pain management literature which includes distraction, cognitive behavioral therapy, and additional promising interventions.

## Psychological Approaches to Acute Pediatric Pain Management

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (International Association for the Study of Pain Subcommittee on Taxonomy, 1986). Across pediatric and adult populations, pain is the most common reason that people seek medical care (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003). Children endure numerous acute painful events within the medical arena. For instance, by the time a child reaches the age of 6, the child might have undergone approximately 30 routine immunization injections (Centers for Disease Control and Prevention, 2008). Previous research suggests that there can be numerous secondary detrimental effects associated with unmanaged pediatric pain. These consequences include neurodevelopmental outcomes (i.e., neuronal plasticity; Woolf & Salter, 2000), future psychological distress (Bjittelier & Vertommen, 1998), and adult medical non-adherence behavior (Pate, Blount, Cohen, & Smith, 1996). Fortunately, there is a rich body of pediatric psychology literature to guide interventions aimed at optimizing pain preparation and management.

### Theories of Pain

#### *Gate Control Theory*

There are several theories that assist in our conceptualization and understanding of the pain experience. The most notable is the Gate Control Theory of Pain (GCT), which provides a scientific framework for understanding the complex mechanisms associated with the experience of pain (Melzack & Wall, 1965). This theory suggests that pain is a result of the interplay between both physiological and psychological factors. GCT proposes that the transmission of nerve impulses from the brain can inhibit (close the gate) or facilitate (open the gate) spinal cord transmission. Thus, descending psychological processes such as thoughts, beliefs, emotions, and

attention are an integral part of the pain experience through their influence on ascending pain signals. For example, children who are reporting increased anticipatory anxiety might have an amplified pain experience, whereas children attending to pleasant stimuli such as a movie or book may have less pain. The complex coordination and interaction of multiple systems highlighted by GCT supports the potential of psychological methods and interventions for influencing the pain experience. The results achieved through neurological/pharmacological-based approaches can also be achieved through behavioral strategies aimed at psychological factors that influence neuronal output.

#### *Biopsychosocial Model of Pain*

Similar to GCT, The Biopsychosocial Model of Pain (BMP) emphasizes a complex interaction among multiple systems. The focus of BMP is the variability of the pain experience that is influenced by biological, psychological, and social factors (for a review, see Asmundson & Wright, 1996). Contributing biological factors include, but are not limited to disease status, tissue/organ damage, and physiological changes. Psychological factors may include an array of subjective experiences or mental states, whereas social factors include cultural contexts or beliefs that influence one's perception of pain. In contrast to the biomedical model, which focuses on the disease or biological condition, BMP's focus is extended to include illness behaviors that are defined as one's perceptions and responses to the biological state (Mechanic, 1962). Additionally, the manner by which these systems interact can vary as a function of individuals, impairment, and time. Thus, the implementation of psychological interventions should also account for the inherent variability of these factors.

#### *Biobehavioral Model of Pediatric Pain.*

Another useful framework for conceptualizing pediatric pain is the Biobehavioral Model of Pediatric Pain (BMPP; Varni, 1989). Varni identified four primary categories of pediatric pain, which include pain associated with chronic illness, pain associated with physical injury, pain not associated with a specific cause, and pain associated with acute medical procedures. BMPP suggests that pain perception and behavior is influenced by several risk and resiliency factors. The variables identified through this model include precipitants (e.g., disease, injury, stress, procedures), intervening variables (e.g., biological predispositions, family environment, cognitive appraisal, coping strategies, perceived social support), and functional status (e.g., activities of daily living, school attendance, depressive symptoms, anxious symptoms, behavioral problems, interpersonal relationships). BMPP's multivariate approach to understanding pediatric pain has laid the groundwork for the implementation of behavioral interventions aimed at reducing children's acute pain experiences.

### Behavioral Intervention Considerations

#### *Developmental Level*

An important consideration of both preparation and management approaches is the child's developmental level. Cognitive development impacts a child's perception of pain such that as they progress through certain developmental stages, their understanding shifts as well. Piaget's (1954) stages of development suggest that children's reasoning is characterized by four stages, which are qualitatively different from one another. Thus, as children progress from the preoperational stage (approximately 2-6 years) to the concrete operational period (7-12 years) their cognitive abilities come to include abstract thinking, perspective flexibility, and mental operations. Research suggests that, as a result of these different developmental stages, preparation interventions are more efficacious for older than younger children (Vernon &

Thompson, 1993). In addition, more abstract assessment (e.g., visual analog scales) and intervention (e.g., imagery) approaches can be used effectively with older children whereas younger children respond better to approaches that are more concrete. Another important maturational achievement is the ability to form insights into one's physiological and psychological processes (Walsh & Bibace, 1991). Younger children are also less able to encode, store, and retrieve information from memory. Their encoding abilities are largely dependent on verbatim information and knowledge, both of which are uniquely flawed resulting in greater forgetting than older children (Brainerd & Ornstein, 1990). Though young children have the capacity to store as much information as older children, their rate of forgetting is much more rapid (Brainerd & Reyna, 1995). Additionally, the ability to retrieve information and apply it to a medical event is influenced by whether they merely observed or actively participated in the intervention (Gobbo, Mega, and Pipe, 2002). Thus, psychological approaches should take into consideration both the developmental and cognitive appropriateness of the intervention.

### *Ethnocultural Variables*

Bronfenbrenner (1979) described an interaction between several social and cultural contexts that influence psychological functioning in children and adults. Specifically, these layers of context consist of the following levels: microsystem (i.e., immediate social relationships), mesosystem (i.e., medical setting, school, church), exosystem (i.e., medical board, insurance companies), and macrosystem (i.e., cultural practices, values, institutions). Though behavioral intervention research is typically concentrated within the microsystem level, it is imperative to consider the complex relations among all of these variables. Further examination of the exosystem level yielded the Institute of Medicine report, through which Smedley, Stith, and Nelson (2002) noted a failure to both recognize and effectively treat pain in minorities.

Additionally, these reports concluded that racial and ethnic minorities are at risk for undertreatment of pain. Though, the majority of health disparities research is focused on adults, it is likely that parents, who are advocates for their children, will have had experiences with disparate care which may indirectly effect children's acute pain experiences. Greater awareness of the history of inequities in pain care is essential to the development of culturally-appropriate, evidence-based practices in pediatric pain preparation and management.

### Behavioral Interventions

Acute medical procedures can be organized into four discreet stages: anticipation, preparation, procedural, and recovery (Fanurik, Koh, Schmitz, & Brown, 1997). During the anticipation phase, medical providers obtain the medical and psychological history in addition to establishing rapport with the family. The preparation phase consists of pre-procedural procedures such as blood draws or other tests (e.g., MRI's), which may lead to increased fear and anxiety in the child. The time period that encompasses the actual medical event is referred to as the procedural phase, which is immediately followed by the recovery phase that provides the child with an opportunity to recover both physically and psychologically from the procedure.

Preparation programs typically occur well in advance up until shortly before the anticipation phase, whereas pain management programs often occur immediately before the anticipation phase and at any subsequent time through all phases including recovery. Behavioral preparation and intervention have been proven to be efficacious clinical interventions for children enduring a range of medical care.

#### *Preparation*

The use of preparative interventions as a way to decrease children's medical distress has been proven effective in a range of stressful pediatric procedures including anesthesia and



surgery (Kain & Caldwell-Andrews, 2005; Margolis et al., 1998), venous access (Cohen, in press), dental procedures (Melamed, Yurcheson, Fleece, Hutcherson, & Hawes, 1978), imaging (Pressdee, May, Eastman, & Grier, 1997), hospitalization (Gross, 1986; Melamed, Meyer, Gee, & Soule, 1976; Nelson, & Allen, 1999), and ear piercing (Spafford, von Baeyer, & Hicks, 2002). Several important features of preparation programs have been identified including timing, format, content, coping skills, and parents (Jaaniste, Hayes, & von Bayer, 2007).

*Timing.* Children who have relatively accurate expectations and are equipped with adequate coping behaviors typically report lower levels of distress during medical procedures and better adjustment post-procedure (Melamed & Ridley-Johnson, 1988). Effective preparatory interventions utilize timely and developmentally-appropriate methods, which lead to increases in children's knowledge coupled with decreases in anxiety and distress. Information should be provided sufficiently in advance of the event so that the child has time to process it (Kain, Mayes, & Caramico, 1996). Information provided too far in advance of the medical procedure could lead to increases in anticipatory anxiety and forgetting of pertinent information (Eiser & Patterson, 1983; Melamed & Ridley-Johnson, 1988). Timing is also related to whether the particular procedure is major or minor. Less invasive procedures, such as immunizations or blood draws may be well-suited to same-day information provisions, whereas major surgeries might require advanced delivery of information (Kain, et al., 1996). However, children's perception might help determine whether or not a procedure is deemed "minor" or "significant" (Cohen, in press).

*Format.* Format is an important aspect of pediatric pain preparation. A variety of information-providing formats have been examined in the literature including computer programs (Franck & Jones, 2003; Rassin, Gutman, & Silner, 2004), videos (Melamed & Siegel,

1975; Peterson & Shigetomi, 1981), puppets (Cassell, 1965) written summaries (Felder-Puig, et al. 2003), live modeling (Klingman, Melamed, Cuthbert, & Hermeicz, 1984), and hospital tours (Gross, 1986; Peterson, Ridley-Johnson, Tracy, & Mullins, 1984). The approach of each format varies in terms of its emphasis on didactics and experiential learning with a combination of some aspect of diversion. Additionally, different behavioral approaches may be useful for children of different ages. Younger children may not have the cognitive capacity to understand that puppets or dolls represent him or herself, suggesting that modeling (in person, video, or computer) may be more developmentally appropriate (Salmon, 2006). Modeling may be especially useful for children with limited experience with the medical procedure or environment. Research suggests that the addition of visual illustrations to written or verbally presented material may optimize memory in children of all ages (McGuigan & Salmon, 2005).

Sociocultural theories emphasize social practice as an integral part of children's learning (Vygotsky, 1978), and research has found that by approximately two months of age, children are able to engage in active interaction (Bateson, 1979). Thus, the format of the preparation intervention should construct an environment where the child is not merely a passive observer or recipient of information. The child should be encouraged to participate in an interactive dialogue where they can ask questions and be fully engaged. In addition to explicit learning, children also engage in implicit learning. Children observe the medical environment, which includes a range of potentially anxiety-provoking visual and auditory stimuli. They may view other children crying, children being pushed in wheel chairs, or healthcare providers with wary expressions and they may hear other children screaming, medical providers speaking amongst themselves in terms they do not understand, or parents attempting to comfort their children. Thus it is critically important to encourage children to actively engage and ask questions as they arise.

*Content.* One of the most important considerations for a preparation program is the content. Given that children's attention may be divided, and younger children do not have the cognitive capacity to anticipate future physical and emotional states, the content and language must be clear, concrete, and developmentally-appropriate. Whereas sensory information in isolation was found to be useful in the reduction of pain and distress, integration of both sensory and procedural information has been shown to be optimally efficacious (Sokolov, 1963; Spafford, et al., 2002; Suls & Wan, 1989; Tak, & van Bon, 2006). Children should be able to predict what will take place during the procedure as well as what they will feel. Thus, the information should be concrete and specific and the language used to convey the information should be developmentally-appropriate because the terminology children often use to describe pain, discomfort, or fear varies as a function of age (Stanford, Chambers, & Craig, 2005). Providing specific sensory and procedural information allows the child to both develop a sense of mastery over the information and an ability to apply the information to their experience. During the medical procedure, the medical provider should continue to guide the child through the steps by outlining the procedural and sensory information in a calm voice with age-appropriate language.

*Coping style and skills.* An additional factor that is integral to a preparation program is the patient's coping style. Lazarus and Folkman (1984) defined stress as the relation between life events and one's responses to those events. This model may be applied to pediatric pain such that pain only becomes a stressor when the child's ability to manage or cope with the stressor, is either insufficient or overwhelmed. Depending on the outcome, coping strategies can either be adaptive or maladaptive. Thus, assessing the utility of the strategy is based on the mechanism by which pain relief is appropriately managed. Common features of coping skills training include

instructing the child to engage in active relaxation (e.g., diaphragmatic breathing, imagery, progressive relaxation) or distraction techniques (e.g., counting backwards, imagery, repeating a mantra, solving problems).

*Parent behavior.* Parents' behaviors during children's medical procedures have been shown to account for a large amount of the variability in children's coping and distress (Cohen, Bernard, Greco, & McClellan, 2002). Whereas parents' presence alone has not been shown to be instrumental in decreasing children's pre-surgical anxiety (Piira, Sugiura, Champion, Donnelly, & Cole, 2005), parents' behavior was found to be an important factor (Caldwell-Andrews, Blount, Mayes, & Kain, 2005). Thus, many preparation programs seek to engage the parents directly through targeting their anxiety (Jay & Elliott, 1990) or indirectly through teaching them to be coaches for the pediatric patient (Cohen, Blount, & Panopoulos, 1997). Though there appears to be no research evaluating whether variability in the quality of information provision provided by different sources is associated with child outcomes, adult modeling of distraction and appropriate coping behaviors have been shown to be associated with decreases in child distress. In contrast, specific parent behaviors have been identified that are positively correlated with child distress include criticizing, apologizing, and providing excessive reassurance (McMurtry, McGrath, & Chambers, 2006).

### *Interventions*

Whereas preparation programs are conducted in advance of the medical procedure, many pain management approaches are implemented during the actual procedure. Specifically, behavioral interventions such as relaxation training (Jay, Elliott, Katz, & Siegel, 1987), breathing exercises (Kazak, Penati, Boyer, Himelstein, Brophy, Waibel, et al., 1996), rehearsal (Powers, Blount, Bachanas, Cotter, & Swan, 1993), positive reinforcement (Jay, et al., 1987), and imagery

(Jay, Elliott, Fitzgibbons, Woody, & Siegel, 1995) have met criteria for “empirically-supported treatments” (Powers, 1999). Distraction, an integral component of the aforementioned interventions, has been supported through a meta-analysis (Kleiber & Harper, 1999). Sucrose administration has been shown to be an effective pain management intervention for neonates and young infants (Barr et al., 1995). In addition to these behavioral approaches, positioning has also been proven beneficial to the pediatric patient, especially for infants and toddlers (Halimaa, 2003; Stephens, Barkey, & Hall, 1999).

*Distraction.* The mechanism by which distraction has been found most effective is through the manipulation of attention. McCaul and Mallott (1984) hypothesized that the brain has a limited capacity to focus attention on stimuli. Once this system is depleted by focusing on an engaging task, there are few resources left for the child to devote to attending to a painful stimuli. In addition to the diversion of attention framework, Cohen (2002) suggests that distracters interfere with the classical condition pathway, whereby attention is diverted away from pain-inducing stimuli in the environment. Distraction has been shown to minimize children’s fear, anxiety, and pain while simultaneously maximizing their coping. Many different forms of distraction stimuli have been researched including movies (Cohen, 2002), interactive toy robots (Pringle et al., 2001), virtual reality goggles (Hoffman et al., 2004), music (Fowler-Kerry & Lander, 1987), bubble-blowing (Sparks, 2001), and short stories (Mason, Johnson, & Wooley, 1999). Regardless of the theoretical explanation or type of strategy, distraction appears to be an effective intervention for pediatric pain management.

Virtual reality distraction, which typically consists of a head mounted display with interactive auditory and visual input has been proven to be an effective behavioral intervention for pediatric burn debridement (Das, 2005), burn rehabilitation (Hoffman, et al., 2001), and

cancer-related procedural pain (Gershon, Zimand, Pickering, Rothbaum, & Hodges, 2004; Wint, Eshelman, Steele, & Gizzetta, 2002). The bulk of the research in virtual reality has been with patients being treated for burn injuries (Lange, Williams, & Fulton, 2006). A variety of virtual reality stimuli have been utilized including videogames, interactive toys, and environmental manipulations such as “Snow World” (Hoffman, Doctor, Patterson, Carrougher, & Furness, 2000). Of note however, there are several drawbacks to the implementation of virtual reality as a behavioral intervention including its high cost and necessity of technical expertise.

Optimal distraction stimuli typically take into account multiple sensory modalities such as vision, hearing, and touch in addition to consideration of both timing and individual factors. A key component is that they promote positive emotional states that are incompatible with pain and distress (Demore & Cohen, 2005). A meta-analysis found distraction to be an equally effective intervention for pediatric pain management across gender and ethnic groups with increased success in children less than 7 years of age (Kleiber, et al., 1999). For older children, there are mixed results regarding the effectiveness of sensory focusing, which involves directing one’s attention toward the sensations of the medical procedure instead of away from it (Fanurik, Zeltzer, Roberts, & Blount, 1993; Piira, Hayes, Goodenough, & von Bayer, 2006). Children who engage in an approach coping style may be able to decrease their own pain and distress by being actively involved in the procedure. Although more research in this area is warranted, the utility of sensory focusing as a form of distraction appears to be closely associated with the child’s particular coping style (Christiano & Russ, 1998). More detailed analyses, examining specific procedural phases suggests that the introduction of distraction stimuli is dependent on the child’s affective state. Distraction interventions implemented prior to the medical procedure reduce

anticipatory anxiety whereas interventions implemented during or after the procedure enhance recovery (Blount, Piira, & Cohen, 2003).

*Cognitive-behavioral treatments (CBTs).* The central tenet of the cognitive-behavioral model is that patients' beliefs and schemas interact with emotional factors and behavioral responses to reinforce adaptive and maladaptive ways of thinking, feeling, and behaving (Turk, 2002). McGrath (1990) noted that the instability of situational factors (cognitive, behavioral, and emotional) interact with the child's individual factors to create a situation where pain is experienced. Cognitive factors include children and parent's knowledge/understanding, behavioral factors encompass children and parent behavioral responses, and emotional factors refer to their feelings about the painful experience. In conjunction with the Society of Pediatric Psychology (SPP) Empirically Supported Treatment Task Force, Powers (1999) concluded that CBT was a well-established intervention for pediatric procedural pain. Powers (1999) outlined several empirically-supported CBT approaches including behavioral rehearsal, breathing exercises, emotive imagery, and positive reinforcement. When compared with pharmacological agents such as valium (Jay, et al., 1987) or EMLA cream (Cohen, et al., 1999), CBT was found to be as effective or superior in decreasing children's pain and distress. CBT approaches have been utilized with several pediatric pain populations including children undergoing bone marrow aspirations (BMAs) or lumbar punctures (LPs; Blount, Powers, Cotter, Swan, & Free, 1994; Kazak, et al., 1996;), injections and venipuncture procedures (Dahlquist, Gil, Armstrong, Ginsberg, & Jones, 1985; Manne, et al., 1990), and routine immunizations (Gonzalez, Routh, & Armstrong, 1993).

*Hypnosis.* Though the mechanism by which hypnosis operates is still unclear, it has been hypothesized that pain reduction occurs indirectly through attention control and dissociation

(Hilgard & Hilgard, 1983; Spiegel & Spiegel, 1978). More recently however, advances in neuroscience have found that during hypnotic states, changes in blood flow and electrical activity have been observed in multiple cerebral regions and in descending pathways of the spine (Danzinger et al., 1998; Rainville et al., 1999). Research has supported the use of hypnosis as a behavioral intervention in the treatment of BMAs (Lioffi & Hatira, 2003), fracture pain (Iserson, 1999), unspecified pain (Uman, Chambers, McGrath, & Kisely, 2006), and postoperative pain (Lambert, 1996). Though the limitations of hypnosis include the lack of a clear operational definition and a minimal understanding of its functional mechanisms, hypnosis appears to be a promising intervention that warrants further research.

*Biofeedback.* Olton & Noonberg (1980) define biofeedback as “any technique which increases the ability of a person to control voluntarily physiological activities by providing information about those activities”. In the pediatric psychology literature, biofeedback has received empirical support in the treatment of acute and chronic pain (Allen, Elliott, & Arndorfer, 2002; Arndorfer & Allen, 2001; Spirito & Kazak, 2006). A meta-analysis revealed that thermal biofeedback in combination with propranolol (a beta-blocker commonly used in the treatment of migraine headaches) yielded an average symptom improvement of 70% in pediatric migraine patients, which is much higher than is typically found in adult patients (Hermann, Kim, & Blanchard, 1993). Additionally, significant decreases in anxiety, analgesic use, headaches, pain intensity and number of pain episodes were found in children with sickle cell disease who participated in six biofeedback sessions (Cozzi, Tryon, & Sedlacek, 1987). Despite the fact that much of the research is confounded by small sample sizes and other treatment confounds, biofeedback appears to be a promising intervention for pediatric acute and chronic pain which requires further investigation.



### *Conclusions*

In sum, given the increasing amount of acute painful procedures that children experience, pediatric pain preparation and management is an area that warrants continued attention. Various theories have guided our understanding of pain and thus informed research, providing strong evidence that children's acute pain can be managed through the implementation of psychological approaches. Developmental and ethnocultural considerations have been proven as important factors that should be taken into account in the management of children's pain. Behavioral approaches, broadly defined in terms of preparation and intervention programs have been proved useful in decreasing children's acute pain. Specifically, preparation programs, with integral features including timing, format, content, individual coping style, and parent behavior, have received support as effective tools in decreasing child distress either directly or indirectly. In tandem, distraction and CBT have been proven as empirically-supported interventions and the clinical utility of hypnosis and biofeedback is encouraging.

There are several future directions for clinical research into pediatric pain management; most importantly, a shift of focus from the microsystem (e.g., parent, child, healthcare providers) to the largely ignored but influential macrosystem (e.g., cultural practices, values, and institutions; Bronfenbrenner, 1979). It is important to recognize that in order to bring about long-term change in the way pediatric pain is both conceptualized and treated, integration of factors outside of the realm of the medical environment are needed. Parents, children, and healthcare providers come together with a prescribed set of values and beliefs, which need to be taken into consideration when developing future behavioral interventions. Second, a more encompassing view of the "patient" is in order; treatments targeting other important individuals such as siblings will ensure optimal pain management. Third, the downward extensions of adult-based

interventions to children should be carefully considered given the unique developmental characteristics of children (McGrath, 2005). Variability in children's cognitive, emotional, and developmental functioning needs to be addressed throughout the intervention approach. Fourth, the link between clinical research and clinical practice needs to be strengthened. As it is the responsibility of the researcher to assure that their interventions are practical and feasible in terms of cost, time, and expertise, clinical practitioners should remain knowledgeable of advances in their field. Fifth, given that much of the research has successfully proven the efficacy of short-term pain relief, investigation into the long-term benefits of pediatric pain management is necessary. Lastly, integration of multiple disciplines such as medicine, nursing, pharmacology, social work, physical therapy, and other health related fields would continue to strengthen the body of literature aimed at alleviating child physical pain and psychological suffering. As science continues to advance, psychology in conjunction with many other disciplines will continue to need to work towards relieving unnecessary child pain through the implementation of evidence-based interventions and treatments.

## References

- Allen, K.D., Elliott, A.J., Arndorfer, R.E. (2002). Behavioral pain management for pediatric headache in primary care. *Children's Health Care, 31*, 175-189.
- Arndorfer, R.E., & Allen, K.D. (2001). Extending the efficacy of a thermal biofeedback treatment package to the management of tension-type headaches in children. *Headache, 41*, 183-192.
- Asmundson, G.J.G., & Wright, K.D. Biopsychosocial approaches to pain. In T. Hadjistavropoulos & K.D. Craig (Eds.), *Biopsychosocial approaches to pain*. (pp. 35-53. Mahwah, NJ: Lawrence Erlbaum Associates.
- Barr, R.G., Young, S.N., Wright, J.H., Cassidy, K.L., Hendricks, L., Bedard, Y., et al. (1995). Sucrose analgesia and diphtheria-tetanus-pertussis immunizations at 2 and 4 months. *Journal of Developmental and Behavioral Pediatrics, 16*, 220-225.
- Bateson, M. (1979). "The epigenesis of conversational interaction": A personal account of research development. In M. Bullowa (Ed.), *Before speech: The beginning of human communication*. New York: Cambridge University Press.
- Bijttebier, P., & Vertommen, H. (1998). Coping with peer arguments in school-age children with bully/victim problems. *Br J Educ Psychology, 68*, 387-394.
- Blount, R., Piira, T., & Cohen, L. (2003). Management of pediatric pain and distress due to medical procedures. In M.C. Roberts (Ed.), *Handbook of pediatric psychology* (pp. 216-233). New York: Guilford Press.
- Blount, R., Powers, S.W., Cotter, M.W., Swan, S.C., & Free, K. (1994). Making the system work: Training pediatric oncology patients to cope and their parents to coach them during BMA/LP procedures. *Behavior Modification, 18*, 6-31.

- Brainerd, C.J., & Ornstein, P.A. (1990). Children's memory for witnessed events: The developmental backdrop. In J Doris (Ed.), *The suggestibility of children's recollections: Implications for eyewitness testimony*. Washington, DC: American Psychological Association.
- Brainerd, C.J., & Reyna, V.F. (1995). Learning rate, learning opportunities, and the development of forgetting. *Developmental Psychology*, *31*, 252-362.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Caldwell-Andrews, A.A., Blount, R.L., Mayes, L.C., & Kain, Z.N. (2005). Behavioral interactions in the perioperative environment: A new conceptual framework and the development of the Perioperative Child-Adult Medical procedure Interaction Scale. *Anesthesiology*, *103*, 1130-1135.
- Cassell, S. (1965). Effect of brief puppet therapy upon the emotional responses of children undergoing cardiac catheterization. *J Consult Psychol*, *29*, 1-8.
- Centers for Disease Control and Prevention. (2008, May). *The recommended immunization schedules for persons aged 0-18 years*. Atlanta, GA.
- Christiano, B., & Russ, S.W. (1998). Matching preparatory intervention to coping style: The effects of children's distress in the dental setting. *Journal of Pediatric Psychology*, *23*, 17-27.
- Cohen, L. L. (in press). Behavioral approaches to anxiety and pain management for pediatric venous access. *Pediatrics*.
- Cohen, L.L. (2002). Reducing infant immunization distress through distraction. *Health Psychology*, *21*, 207-211.

- Cohen, L.L., Bernard, R.S., Greco, L.R., & McClellan, C.B. (2002). A child-focused intervention for coping with procedural pain: Are parent and nurse coaches necessary? *Journal of Pediatric Psychology, 27*, 749-757.
- Cohen, L.L., Blount, R.L., Cohen, R.J., Schaen, E.R., & Zaff, J.F. (1999). A comparative study of distraction versus topical anesthesia for pediatric pain management during immunizations. *Health Psychology, 22*, 355-370.
- Cohen, L.L., Blount, R.L., & Panopoulos, G. (1997). Nurse coaching and cartoon distraction: An effective and practical intervention to reduce child, parent, and nurse distress during immunizations. *Journal of Pediatric Psychology, 18*, 591-598.
- Cozzi, L., Tryon, W.W., Sedlacek, K. (1987). The effectiveness of biofeedback-assisted relaxation in modifying sickle cell crises. *Applied Psychophysiology and Biofeedback, 12*, 51-61.
- Dahlquist, L.M., Gil, K.M., Armstrong, F.D., Ginsberg, A., & Jones, B. (1985). Behavioral management of children's distress during chemotherapy. *Journal of Behavior Therapy and Experimental Psychiatry, 16*, 325-329.
- Danzinger, N., Fournier, E., Bouhassira, D., Michaud, D., De Broucker, T., Santarcangelo, E., Carli, G., Chertock, L., & Willer, J.C. (1998). Different strategies of modulation can be operative during hypnotic analgesia: A neuropsychological study. *Pain, 75*, 85-92.
- Das, D., Grimmer, K., Sparnon, A., McRae, S., & Thomas, B. (2005). The efficacy of playing a virtual reality game in modulating pain for children with acute burn injuries: A randomized controlled trial. *BMC Pediatrics, 5*, 1-10.
- Demore, M., & Cohen, L.L. (2005). Distraction for pediatric immunization pain: A critical review. *J Clin Psychol Med Set, 12*, 281-291.

- Eiser, C., & Patterson, D. (1983). 'Slugs and snails and puppy-dog tails'-children's ideas about the inside of their bodies. *Child Care Health Dev*, 9, 233-240.
- Fanurik, D., Koh, J., Schmitz, M., & Brown, R. (1997). Pharmacobehavioral intervention: Integrating pharmacological and behavioral techniques for pediatric medical procedures. *Children's Health Care*, 26, 31-46.
- Fanurik, D., Zeltzer, L., Roberts, M., & Blount, R.L. (1993). The relationship between children's coping styles and psychological interventions for cold pressor pain. *Pain*, 53, 213-222.
- Felder-Puig, R., Maksys, A., Noestlinger, C., Gadner, H., Stark, H., Pfluegler, A., et al. (2003). Using a children's book to prepare children and parents for elective ENT surgery: Results of a randomized clinical trial. *Int J Pediatr Otorhinolaryngol*, 67, 35-41.
- Fowler-Kerry, S., & Lander, J.R. (1987). Management of injection pain in children. *Pain*, 30, 169-175.
- Franck, L.S., & Jones, M. (2003). Computer-taught coping techniques for venipuncture: Preliminary findings from usability testing with children, parents, and staff. *Journal of Child Health Care*, 7, 41-54.
- Gershon, J., Zimand, E., Pickering, M., Rothbaum, B.O., Hodges, L. (2004). A pilot and feasibility study of virtual reality as a distraction for children with cancer. *Journal of the Academy of Child and Adolescent Psychiatry*, 43, 1243-1249.
- Gobbo, C., Mega, C., & Pipe, M.E. (2002). Does the nature of the experience influence suggestibility? A study of children's event memory. *Journal of Experimental Child Psychology*, 81, 419-428.

- Gonzalez, J.C., Routh, D.K., & Armstrong, F.D. (1993). Effects of maternal distraction versus reassurance on children's reactions to injections. *Journal of Pediatric Psychology, 18*, 593-604.
- Gross, S. (1986). Pediatric tours of hospitals: Positive or negative? *American Journal of Maternal Child Nursing, 11*, 336-338.
- Halimaa, S-L. (2003). Pain management in nursing procedure in premature babies. *Journal of Advanced Nursing, 42*, 587-597.
- Hermann, C.U., Kim, M., & Blanchard, E.B. (1993). The efficacy of behavioral intervention in the treatment of pediatric migraine: A meta-analytic review. In *Proceedings of the 24<sup>th</sup> Annual Meeting of the Association for Applied Psychophysiology and Biofeedback* (pp. 149-154). Wheatridge, CO: Association for Applied Psychophysiology and Biofeedback.
- Hilgard, E.R., & Hilgard, J.R. (1983). *Hypnosis in the relief of pain* (Rev ed.). Los Altos, CA: Kaufmann.
- Hoffman, H.G., Doctor, J.N., Patterson, D.R., Carrougher, G.J., & Furness, T.A. (2000). Virtual reality as an adjunctive pain control during burn wound care in adolescent patients. *Pain, 85*, 305-309.
- Hoffman, H.G., Patterson, D.R., Magula, J., Carrougher, G.J., Zeltzer, K., Dagadakis, S., et al. (2004). Water-friendly virtual reality pain control during wound care. *Journal of Clinical Psychology, 60*, 189-195.
- International Association for the Study of Pain Subcommittee on Taxonomy. (1986). Classification of chronic pain syndromes and definitions of pain terms. *Pain, Volume 3* (Suppl. 3), S1-S226.

- Iserson, K.V. (1999). Hypnosis for pediatric fracture reduction. *Journal of Emergency Medicine*, *17*, 53-56.
- Jaaniste, T., Hayes, B., & von Bayer, C.L. (2007). Providing children with information about forthcoming medical procedures: A review and synthesis. *Clin Psychol Sci Prac*, *14*, 124-143.
- Jay, S.M., & Elliott, C.H. (1990). A stress inoculation program for parent whose children are undergoing painful medical procedures. *J Consult Clin Psychol*, *58*, 799-804.
- Jay, S.M., Elliott, C.H., Fitzgibbons, I., Woody, P., & Siegel, S. E. (1987). An investigation of cognitive-behavior therapy combined with oral Valium for children undergoing medical procedures. *Health Psychology*, *10*, 133-147.
- Jay, S.M., Elliott, C.H., Katz, E., & Siegel, S.E. (1987). Cognitive-behavioral and pharmacological interventions for children's distress during painful medical procedures. *Journal of Consulting and Clinical Psychology*, *55*, 860-865.
- Kain, Z.N., & Caldwell-Andrews, A.A. (2005). Preoperative psychological preparation of the child for surgery: An update. *Anesthesiology Clin North America*, *23*, 597-614.
- Kain, Z.N., Mayes, L.C., & Caramico, L.A. (1996). Preoperative preparation in children: A cross-sectional study. *J Clin Anesth*, *8*, 508-514.
- Kazak, A.E., Penati, B., Boyer, B.A., Himelstein, B., Brophy, P., Waibel, M.K., et al. (1996). A randomized controlled prospective study of a psychological and pharmacological intervention protocol for procedural distress in pediatric leukemia. *Journal of Pediatric Psychology*, *21*, 615-631.
- Kleiber, C., & Harper, D.C. (1999). Effects of distraction on children's pain and distress during medical procedures: A meta-analysis. *Nursing Research*, *48*, 44-49.



- Klingman, A., Melamed, B.G., Cuthbert, M.I., Hermeecz, D.A. (1984). Effects of participant modeling on information acquisition and skill utilization. *J Consult Clin Psychol*, *52*, 414-422.
- Lambert, S.A. (1996). The effects of hypnosis/guided imagery on the postoperative course of children. *Journal of Developmental Behavioral Pediatrics*, *17*, 307-310.
- Lange, B., Williams, M., & Fulton, I. (2006). Virtual reality distraction during pediatric medical procedures. *Pediatric Pain Letter*, *8*, 6-10.
- Lazarus, R.S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Basic Books.
- Lioffi, C., & Hatira, P. (1999). Clinical hypnosis versus cognitive behavioral training for pain management with pediatric cancer patients undergoing bone marrow aspirations. *International Journal of Clinical and Experimental Hypnosis*, *47*, 104-116.
- Manne, S.L., Redd, W.H., Jacobsen, P.B., Gorfinkle, K., Schorr, O., & Rapkin, B. (1990). Behavioral intervention to reduce child and parent distress during venipuncture. *Journal of Consulting and Clinical Psychology*, *58*, 565-572.
- Margolis, J.O., Ginsberg, B., Dear, G.L., Ross, A.K., Goral, J.E., Bailey, A.G. (1998). Paediatric preoperative teaching: Effects at induction postoperatively. *Paediatr Anaesth*, *8*, 17-23.
- Mason, S., Johnson, M.H., & Wooley, C. (1999). A comparison of distracters for controlling distress in young children during medical procedures. *J Clin Psychol Med Settings*, *6*, 239-248.
- McCaul, K.D., & Malott, J.M. (1984). Distraction and coping with pain. *Psychol Bull*, *95*, 516-533.
- McGrath, P.A. (1990). *Pain in children: Nature, assessment, & treatment*. New York: Guilford.

- McGrath, P.A. (2005). Children – Not simply “little adults”. In E. Merskeuy, J.D. Loeser, & R. Dubner, (Eds.), *The Paths of Pain 1975-2005*. Seattle: IASP Press.
- McGuigan, F., & Salmon, K. (2005). Pre-event discussion and recall of a novel event: How are children best prepared? *Journal of Experimental Child Psychology*, *91*, 342-366.
- McMurtry, C., McGrath, P., & Chambers, C. (2006). Reassurance can hurt: Parental behavior and painful medical procedures. *The Journal of Pediatrics*, *148*, 560-561.
- Mechanic, D. (1962). The concept of illness behavior. *Journal of Chronic Disease*, *15*, 189-194.
- Melamed, B., Meyer, R., Gee, C., & Soule, L. (1976). The influence of time and type of preparation on children’s adjustment to hospitalization. *Journal of Pediatric Psychology*, *1*, 31-37.
- Melamed, B.G., & Ridley-Johnson, R. (1988). Psychological preparation of families for hospitalization. *J Dev Behav Pediatr*, *9*, 96-102.
- Melamed, B.G., & Siegel, L.J. (1975). Reduction of anxiety in children facing hospitalization and surgery by use of filmed modeling. *J Consult Clin Psychol*, *43*, 511-521.
- Melamed, B.G., Yurcheson, R., Fleece, E.L., Hutcherson, S. & Hawes, R. (1978). Effects of film modeling on the reduction of anxiety-related behaviors in individuals varying in level of previous experience in the stress situation. *J Consult Clin Psychol*, *46*, 1357-1367.
- Melzack, R., & Wall, P.D. (1965). Pain mechanisms: A new theory. *Science*, *150*, 971-979.
- Nelson, C., & Allen, J. (1999). Reduction of healthy children’s fears related to hospitalization and medical procedures: The effectiveness of multimedia computer instruction in pediatric psychology. *Child Health Care*, *28*, 1-13.
- Olton, D.S., & Noonberg, A.R. (1980). *Biofeedback: Clinical applications in behavioral medicine*. Englewood Cliffs, NJ: Prentice-Hall.

- Pate, J., Blount, R., Cohen, L., & Smith, A. (1996). A childhood medical experience and temperament as predictors of adult functioning in medical situations. *Children's Health Care, 25*, 281-298.
- Peterson, L., Ridley-Johnson, R., Tracy, K., & Mullins, L.L. (1984). Developing cost-effective presurgical preparation: A comparative analysis. *Journal of Pediatric Psychology, 9*, 439-455.
- Peterson, L., & Shigetomi, C. (1981). The use of coping techniques to minimize anxiety in hospitalized children. *Behav Ther, 12*, 1-14.
- Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.
- Piira, T., Hayes, B., Goodenough, B., & von Bayer, C.L. (2006). Effects of attentional direction, age, and coping style on cold pressor pain. *Behavior Research & Therapy, 44*, 835-848.
- Piira, T., Sugiura, T., Champion, G.D., Donnelly, N., & Cole, A.S. (2005). The role of parental presence in the context of children's medical procedures: A systematic review. *Child Care Health Dev, 31*, 233-243.
- Powers, S.W. (1999). Empirically supported treatments in pediatric psychology: Procedure related pain. *Journal of Pediatric Psychology, 24*, 131-145.
- Powers, S.W., Blount, R.L., Bachanas, P.J., Cotter, M.W., & Swan, S.C. (1993). Helping pre-school leukemic patients and their parents to cope during injections. *Journal of Pediatric Psychology, 18*, 681-695.
- Pressdee, D., May, L., Eastman, E., & Grier, D. (1997). The use of play therapy in the preparation of children undergoing MR imaging. *Clin Radiol, 52*, 945-947.

Pringle, B., Hilley, L., Gelfand, K., Dahlquist, L.M., Switkin, M., Diver, T., et al. (2001).

Decreasing child distress during needle sticks and maintaining treatment gains over time.

*J Clin Psychol Med Settings*, 8, 119-130.

Rainville, P., Hofbauer, R.K., Paus, T., Duncan, G., Bushnell, M.C., & Price, D.D. (1999).

Cerebral mechanisms of hypnotic induction and suggestion. *Journal of Cognitive*

*Neuroscience*, 11, 110-125.

Rassin, M., Gutman, Y., & Silner, D. (2004). Developing a computer game to prepare children

for surgery. *Association of Perioperative Registered Nurses*, 80, 1095-1102.

Salmon, K. (2006). Commentary: Preparing young children for medical procedures: Taking

account of memory. *Journal of Pediatric Psychology*, 31, 859-861.

Smedley, B.D., Stith, A.Y., Nelson, A.R., & editors. (2002). *Unequal treatment: Confronting*

*racial and ethnic disparities in healthcare*. Washington, DC. National Academy Press.

Sokolov, E.N. (1963). *Perception and the conditioned reflex*. New York: Macmillan.

Spafford, P.A., von Bayer, C.L., & Hicks, C.L. (2002). Expected and reported pain in children

undergoing ear piercing: A randomized trial of preparation by parents. *Behav Res Ther*, 40, 253-256.

Sparks, L. (2001). Taking the “ouch” out of injections for children. Using distraction to decrease

pain. *MCN Am J Matern Child Nurs*, 26, 72-78.

Spiegel, H., & Spiegel, D. (1978). *Trance and treatment: Clinical uses of hypnosis*. New York:

Basic Books.

Spirito, A., & Kazak, A.E. (2006). *Effective & emerging treatments in pediatric psychology*.

New York: Oxford University Press.

- Stewart, W.F., Ricci, J.A., Chee, E., Morganstein, D., & Lipton, R. (2003). Lost productive time and cost due to common pain conditions in the US work force. *JAMA*, *290*, 2443-2454.
- Suls, J., & Wan, C.K. (1989). Effects of sensory and procedural information on coping with stressful medical procedures and pain: A meta analysis. *Journal of Consulting and Clinical Psychology*, *57*, 372-379.
- Stanford, E.A., Chambers, C.T., & Craig, K.D. (2005). A normative analysis of the development of pain-related vocabulary in children. *Pain*, *114*, 278-284.
- Stephens, B.K., Barkey, M.E., & Hall, H.R. (1999). Techniques to comfort children during stressful procedures. *Accid Emerg Nurs*, *7*, 226-236.
- Tak, J.H., & von Bon, W.H.J. (2006). Pain- and distress-reducing interventions for venipuncture in children. *Child Care, Health, and Development*, *32*, 257-268.
- Turk, D.C. (2002). A cognitive-behavioral perspective on treatment of chronic pain patients. In D.C. Turk and R.J. Gatchel (Ed.), *Psychological approaches to pain management: A practitioner's handbook, second edition* (pp. 138-158). New York: Guilford Press.
- Varni, J.W. (1989, October). *An empirical model for the biobehavioral investigation of pediatric pain*. Invited plenary address at the annual meeting of the American Pain Society, Phoenix, AZ.
- Vernon, D.T., & Thompson, R.H. (1993). Research on the effect of experimental interventions on children's behavior after hospitalization: A review and synthesis. *J Dev Behav Pediatr*, *14*, 36-44.
- Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Walsh, M.E., & Bibace, R. (1991). Children's conceptions of AIDS: A developmental analysis.

*Journal of Pediatric Psychology, 16*, 273-285.

Wint, S., Eshelman, D., Steele, J., & Guzzetta, C. (2002). Effects of distraction using virtual

reality glasses during lumbar punctures in adolescents with cancer. *ONF, 29*, 8-15.

Woolf, C.J. & Salter, M.W. (2000). Neuronal plasticity: increasing the gain in pain. *Science, 288*,

1765-1769.

Uman, L.S., Chambers, C.T., McGrath, P.J., & Kisely, S. (2006). Psychological interventions for

needle-related procedural pain and distress in children and adolescents. *The Cochrane*

*Database of Systematic Reviews, 4*.